Improvements in Aqueous Degreasing

- Filtration and Rejuvenation of Aqueous Cleaners Reduces Impact on Waste Water
  - Conventional Filtration to Remove Dirt
    - Bag Filters (10 to 250 micron)
  - Skimmers and Coalescers to Remove Free Oil
    - Does Not Work for Aqueous Cleaners that Emulsify the Oil
  - Microfiltration to Remove Emulsified Oil
    - Microfilters 0.1 - 0.5 Micron Size are Being Tested
    - Removal of Cleaner Components is a Concern

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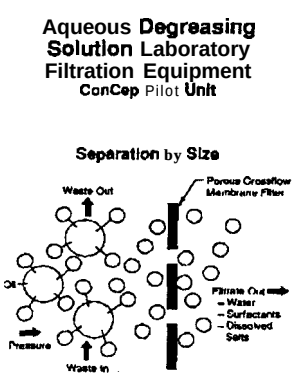
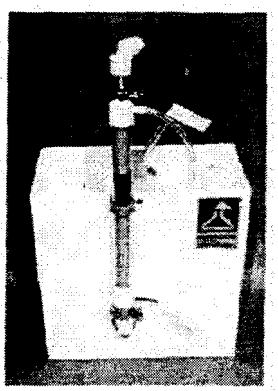
Microfiltration of Aqueous Degrease Solution





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TCA Vapor Degreaser Replacements

- Identify Uses
  - Electrical Part Cleaning
    - Circuit Boards
- Identify Soils
  - Solder Flux and Finger Prints
- Identify Requirements
  - MIL-STD-2000 and P.S. 12023 Cleanliness Req.
    - < 1.55 microgram/cm^2 of ionic contamination
    - > 7.9 megohm-cm resistivity

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TCA Vapor Degreaser Replacements

- Identify Alternate Cleaning Materials
  - Semi-Aqueous or Solvent (Contains VOCs)
  - Aqueous
  - No Clean (Use a No Clean Solder Flux)
- Identify Alternate Cleaning Methods
  - Immersion with Agitation or Spray (or Both)

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TCA Vapor Degreaser Replacements

- Solvent Degreasing Preferred over Aqueous
  - Pros
    - Effectively Removes Solder Flux
      - Meets MIL-STD-2000 & P.S. 12023
    - No Corrosion or White Residue Forms on Parts
  - Cons
    - Contains VOCs
    - Ventilation Required
    - Slight Odor - Flammable

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TCA Vapor Degreaser Replacements

- Four Solvents Evaluated
  - KNI2000, K4 11, Micropure CDF, Axarel 2200
- Isopropyl Alcohol (IPA) is Rinse Agent
- Process Flow:

SOLVENT CLEAN 5 MINUTES → DRIP EXCESS OFF → RINSE IN IPA 5 MINUTES → FORCED AIR DRY

- Two Cleaning Methods Evaluated
  - Jetclean and Re-Entry (Agitated Immersion Tanks)

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TCA Vapor Degreaser Replacements

Results of Cleaner Evaluation for Circuit Boards

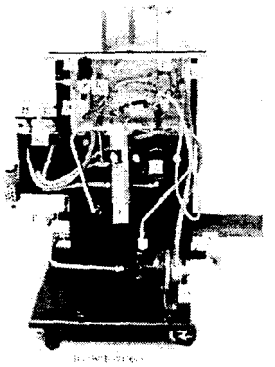
CLEANER	Average Contamination After Cleaning in Jetclean Unit (µgrams/cm^2)*	Average Contamination After Cleaning in Reentry Unit (µgrams/cm^2)*	Odor Index (10 being worse, 1 being best)	Cost/Gal.
1,1,1-TCA	0.0012	0.0012	1	$23.00
KNI 2000	0.0725	0.0034	8	$16.25
K411	0.0057	0.0085	8	$16.64
Micropure CDF	0.0018	0	4	$23.66
Axarel 2200	0.00006	0.0034	2	$37.00

* Ionic Contamination Requirement is < 1.55 micrograms/cm^2

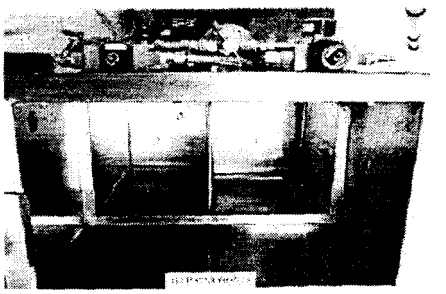
TCA Vapor Degreaser Replacements

- Materials Selected (Specified in P.S. 12026)
  - Micropure CDF and Axarel 2200
    - Good Cleaning and Low Odor
- Re-Entry Cleaning Equipment Selected
  - Consists of Retrofit Kit That Can Convert Existing Vapor Degreaser to Electrical Parts Cleaner System
- Six Re-Entry Units Installed at MDA-STL
  - Safety Concerns Addressed with Proper Ventilation and Explosion Proof Controls

Reentry Cleaning Unit



Rear View



Top View Looking Inside

TCA Handwipe Solvent Replacement

- Identify Uses
  - General Cleaning, Uncured Sealant Removal, Hydraulic Fluid Cleaner
- Identify Soils
  - Finger Prints, Ink, Wax, Oil, Grease
- Identify Cleaning Requirements
  - Measure Adhesion Strengths of Sealants, Adhesives, and Paints on Parts After Cleaning

TCA Handwipe Solvent Replacement

- Physical Property Criteria for TCA H.W. Replacement Candidates
  - Non-Hazardous (PEL > 50 ppm) & Non-ODS
  - Low or No VOC
  - Flash Point < 100° F
  - Vapor Pressure < 130 mm Hg
  - Dry in < 10 minutes
  - NVR < 25 mg/100 ml
  - Silicone < 0.05 micrograms/liter

TCA Handwipe Solvent Replacement

- Hundreds of Cleaners Tested By Many Aerospace Companies
- Many Good Cleaners Were Rejected Because of Odor Problems
  - Shop Workers Became Nauseated by Smell Even Though Solvents were Non-Toxic
- Slow Evaporation Was Two Sided Sword
  - Long Dry Times Affect Cleaning Cycle Times
  - Surface Remained Wet Longer - This Improved Cleaning and ~ 70% Less Solvent Needed